No. : IM-E3293-2C

FURUNO

INSTALLATION MANUAL

MARINE RADAR

MODEL FCR-902

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

900210KS(9002,itam)
PRINTED IN JAPAN

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FURUNO

EQUIPMENT LIST

No.	Name	Type	Weight (kg)	Q'ty
1	Scanner Unit	XC1P9N2N9D1	19	1
2	Display Unit	RDP-048	12	1
3	Accessories	FP03-02100		1 set
4	Standard Spare Parts	SP03-02800		1 set
5	Installation Materials			1 set

OPTIONAL SUPPLY

No.	Name	Type	Weight (kg)	Q'ty	Remarks
1	Rectifier	RU-3423	16.5	1	AC mains only
2	Power Cable	VV-S 2.0x2C		1	Cable length:5m
3	External Buzzer	OP03-21		1	For alarm
4	Vinyl Cover	03-019-0401		1	Code No. 008-280-560

ACCESSORIES (Type: FP03-02100, Code No.: 000-081-102)

No.	Name	Type	Code No.	Q'ty
1	Hood Assy.	FP03-02110	008-280-550	1

STANDARD SPARE PARTS (Type: SP03-02800, Code No.: 000-081-103)

No.	Name	Type	Code No.	Q'ty
1	Fuse	FGBO 15A AC125V	000-549-014	2
2	Fuse	FGBO 1A AC125V	000-549-061	2
3	Fuse	FGBO 10A AC125V	000-549-065	2
4	Hex. Wrench	Diagonal: 1.5mm	000-830-112	1
5	Spare Parts Box	For F710	000-831-610	1

INSTALLATION MATERIALS

For Display Unit

No.	Name	Type	Code. No.	Q'ty	Remarks
1	Connector	16P2B	000-500-346	1	For power cable
2	Signal Cable Assy.	S03-11-10 (10m)	008-204-690	1	To be selected (With connector at display end)
		S03-11-15 (15m)	008-204-700		
		S03-11-20 (20m)	008-204-710		
		S03-11-30 (30m)	008-204-720		

For Scanner Unit (Type: CP03-02701, Code No.: 008-206-950)

No.	Name	Type	Code No.	Q'ty	Remarks
1	Crimp-on Lug	FV5.5-4	000-538-122	1	
2	Crimp-on Lug	FV1.25-3 RED	000-538-113	20	
3	Fitting Metal	ML	000-570-342	1	
4	Hex. Bolt	M12x60 SUS304	000-862-191	4	
5	Hex. Nut	M12 SUS304	000-863-112	4	
6	Flat Washer	M12 SUS304	000-864-132	4	
7	Spring Washer	M12 SUS304	000-864-263	4	
8	Seal Washer	CW1053DX	000-850-021	4	
9	Drain Tube	03-003-3001-0	300-330-010	1	
10	Safety Lanyard	03-003-3002-0	300-330-020	1	
11	Label (7)	03-004-0207-0	300-402-070	1	

CHAPTER 1 INSTALLATION INSTRUCTIONS

1.1 General

This radar system is mainly composed of two units; the display unit and the scanner unit, and operates directly from 12/24/32VDC. For the operation from 100/110/115/220/240VAC ship's mains, the rectifier unit (RU-3423) is additionally used. When the radar is first unpacked, check that all necessary units, parts and materials are contained. Refer to the equipment, installation materials and spare parts lists. The steel and wood works should be arranged locally.

1.2 Scanner Unit

Scanner Unit Siting Considerations

The scanner unit is generally installed either on top of the wheelhouse or on the radar mast on an appropriate platform. When siting the unit, consider the following points.

1. The interconnecting cable run between the scanner and the display is 10m long. If additional cable is required for a particular installation, an unbroken length must be used (i.e., no splices allowed!), and the maximum length is 30 meters.

2. Any large metallic objects such as funnels, masts or derrick posts around the radar scanner may well block its line of sight, causing blind sectors in the radar picture. The sector directly ahead is obviously most important to the radar operator, so carefully plan the site of the scanner so the forward area is clear of obstructions.

3) Deposits and fumes from a funnel or other exhaust vent can adversely affect the performance of the antenna, since hot gases may distort the radome. The scanner unit must not be mounted in a position where it may be subjected to temperatures in excess of 70° C.

4) The compass safe distance, 3.10m, standard compass and 1.75m, steering compass, should be observed.

5) The unit must not be positioned in close proximity to a radio direction finder antenna, since the DF would be adversely affected. A separation of more than 2 meters is recommended.

Scanner Unit Preparation and Unpacking

1) Open the radome package carefully. Unbolt the four screws used to hold the white radome to the blue mounting base, and carefully lift the radome up over the insides of the dome.

2) Remove the protection caps from the end of the scanner, and remove the two bolts securing the stopper bracket to the scanner. This will release the scanner from its shipping preparation position, and allow it to rotate freely, as well as to allow access to the transceiver assembly.

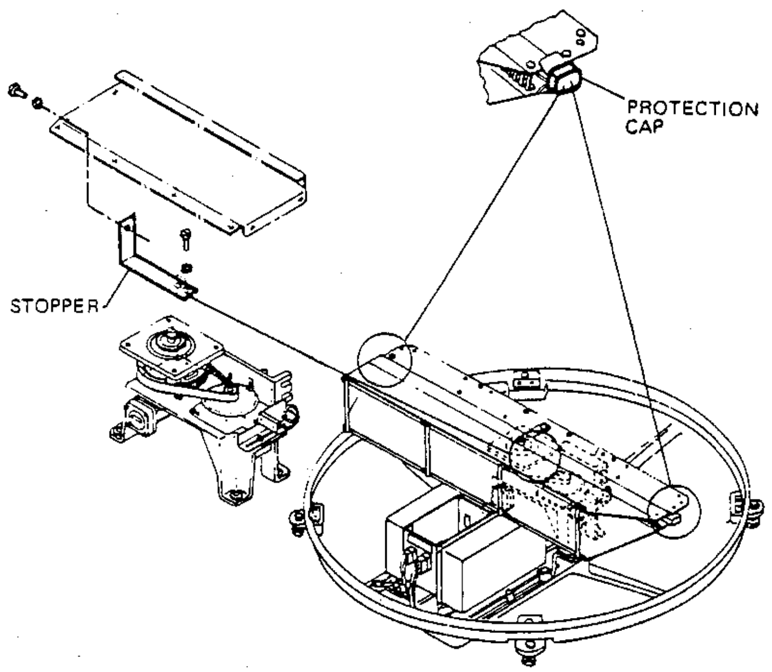


Fig.1-1

3) Unplug connectors P614 and P801 going into the transceiver, and then undo the two M8 x 16 hex. bolts securing the transceiver to the mounting plate. The transceiver assembly may then be slid out from under the scanner and placed in a safe location temporarily while the radome base is secured to the radar mounting platform.

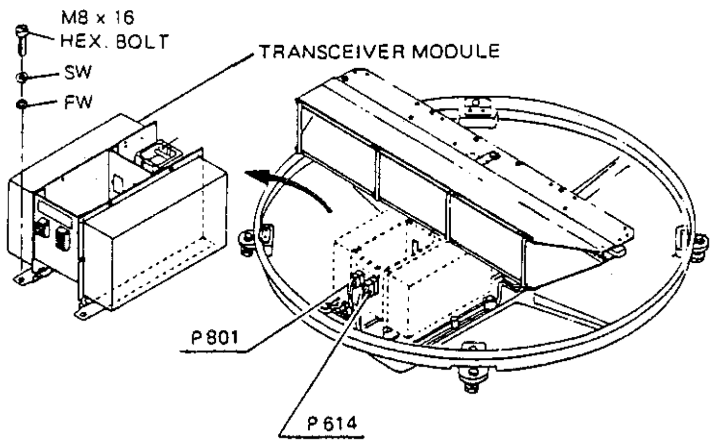
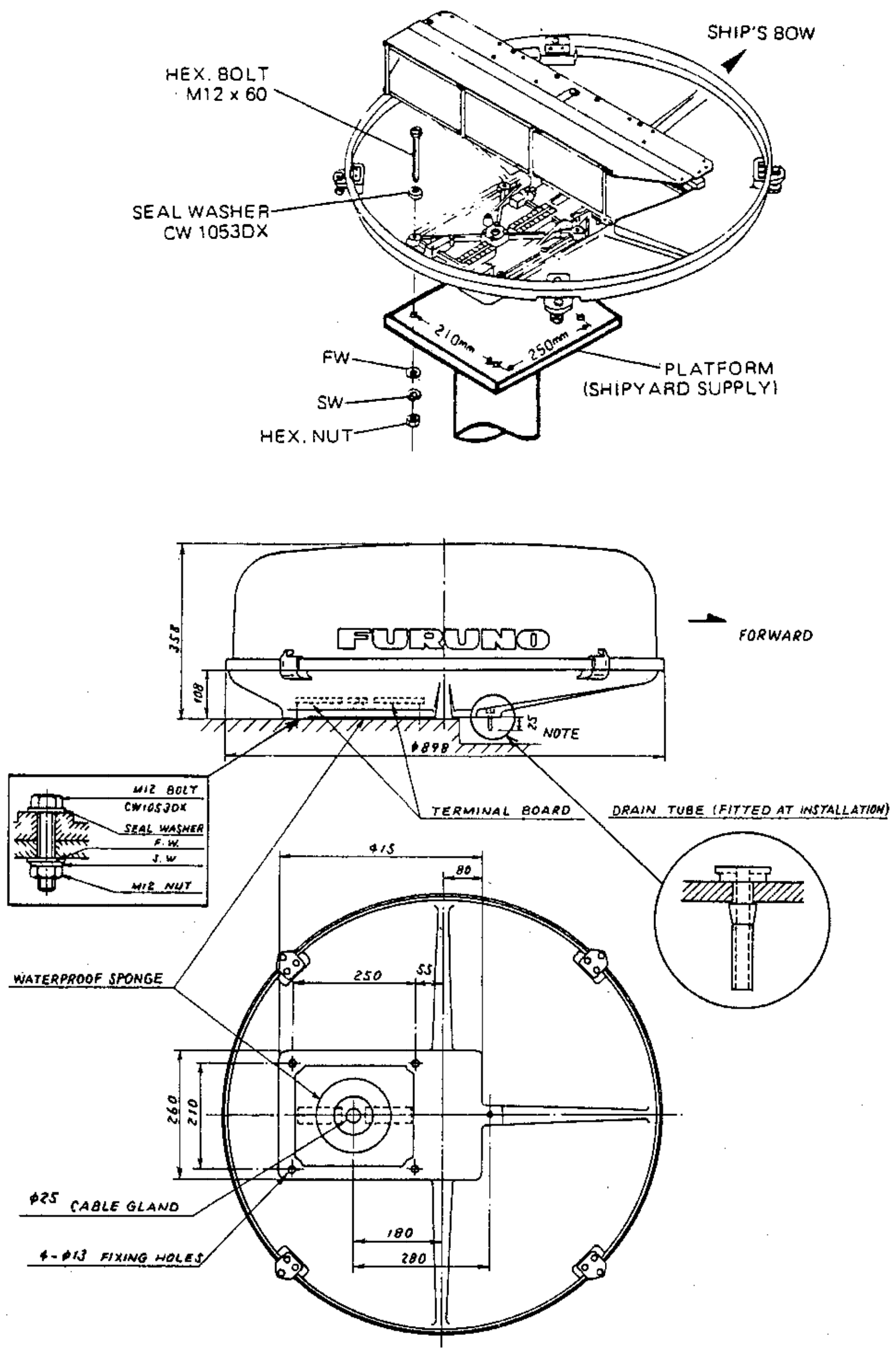


Fig.1-2

Scanner Unit Mounting

4) Now install the bottom mounting base of the radome on the radar platform using four M12 x 60 bolts, paying attention to the orientation of the unit.



NOTE PROVIDE A SPACE OF 80MM AROUND AND 50MM BELOW THE DRAIN HOLE TO INSTALL THE DRAIN TUBE.

Fig.1-3

5) Remove the black rubber blind to expose the hole for installation of the drain tube. Make sure that the drain tube is fully inserted into the hole. It is important that there is sufficient free space beneath the bottom of the drain tube for it to "breathe", thereby allowing the radome cover to expand and contract as necessary during ambient temperature variations. DO NOT allow the bottom of the drain tube to contact the mounting platform surface, since this could allow water to be drawn up by capillary action into the dome.

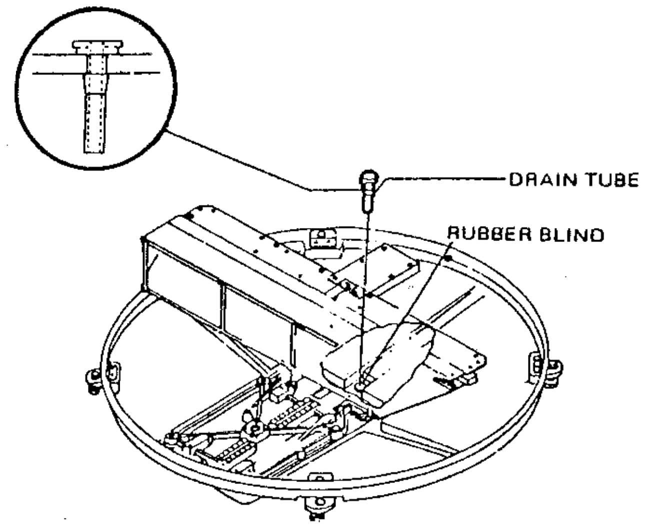
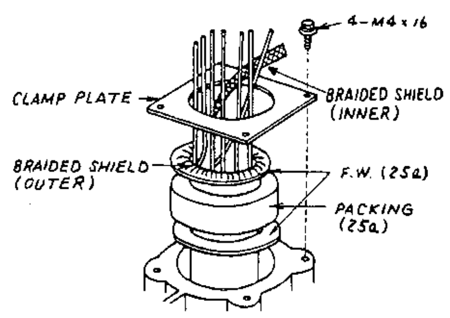


Fig.1-4

Wiring and Final Preparation of Scanner Unit

6) Run the interconnect cable from the display unit into the scanner base, taking special precaution to make sure that the cable grand is properly installed to prevent water leakage into the dome around the cable. See the drawing below.



DETAIL OF CABLE ENTRY

Fig.1-5

7) Dress the interconnect cable wires neatly and terminate each wire with a crimp-on lug. The harness thus formed should be laced with lacing twine or plastic "tie-wraps". Make sure that each wire is prepared so that there is some insulation crimped at the back end of the crimp-on lug in order to provide mechanical integrity for the connection. Make sure that there is enough bare wire in the forward end of the crimp-on lug to ensure the integrity of the electrical connection.

Scanner Unit

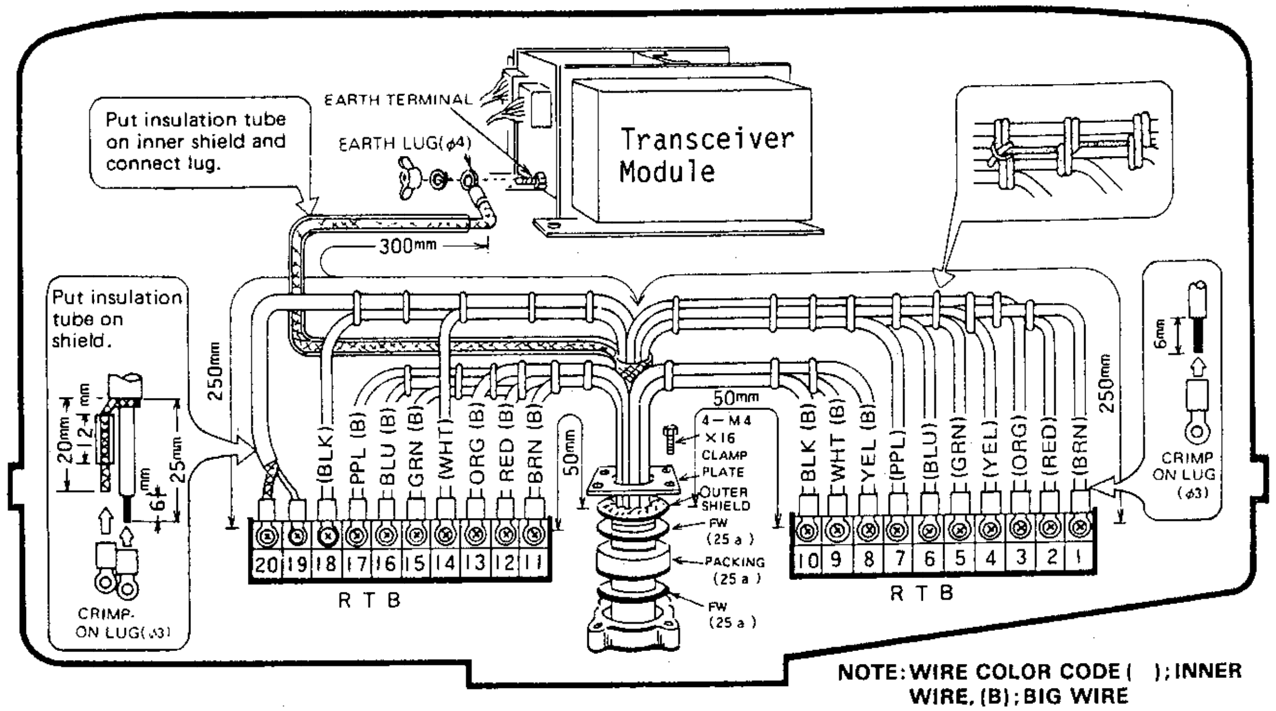
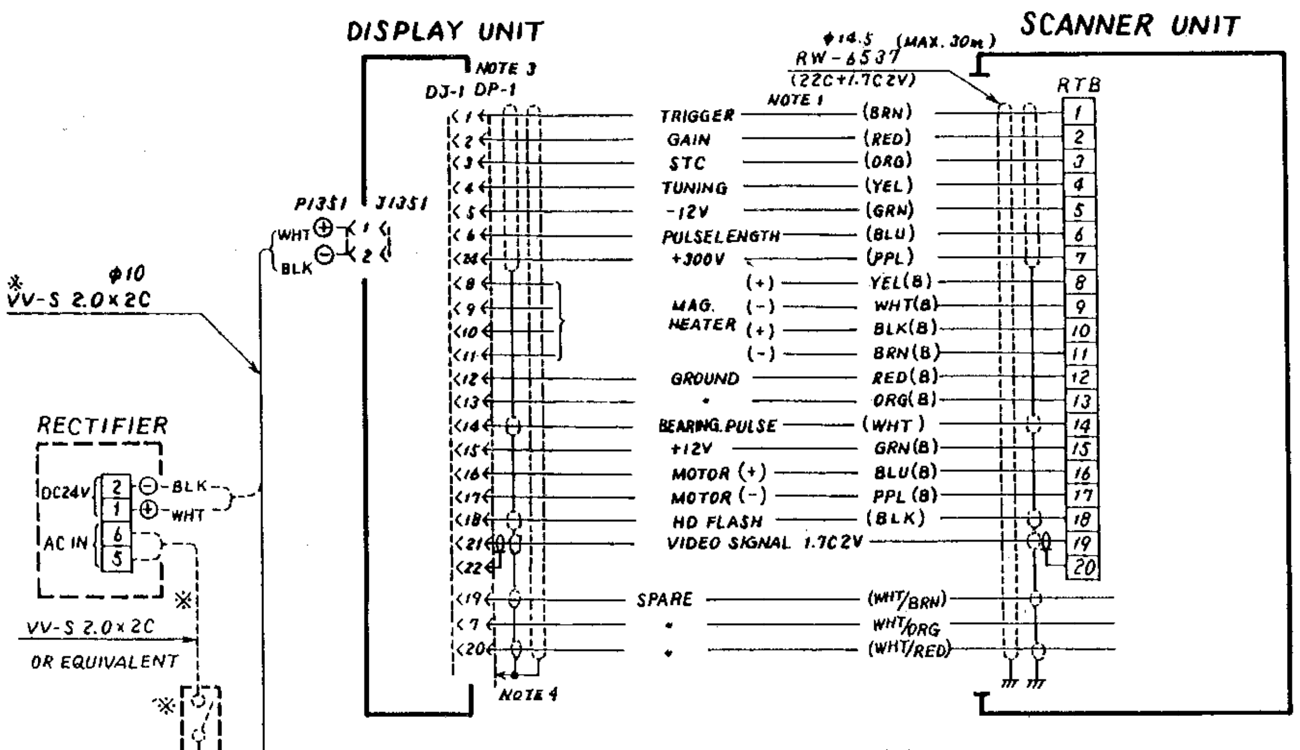


Fig.1-6



NOTE: 1. WIRE COLOR CODE ( ): INNER WIRES, (B): BIG WIRES.
2. SHIELD SHOULD BE EFFECTIVELY GROUNDED AT SCANNER UNIT.
3. CONNECTOR PLUG PREVIOUSLY FITTED.
4. SHIELD GROUNDED THRU CONNECTOR CASE.
5. ※SHIPYARD SUPPLY.

Fig.1-7

8) After the wiring has been completed and has been inspected by another person to verify accuracy, reinstall the transceiver assembly. Make sure that the guide holes on the waveguide flange of the transceiver are mated properly with the guide pins on the transceiver waveguide output.

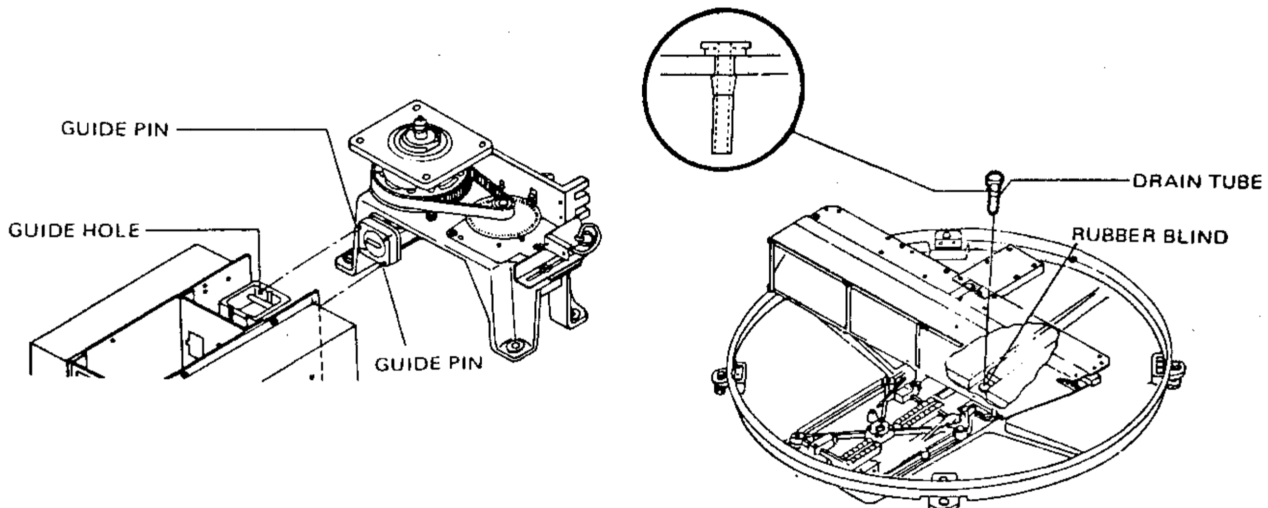


Fig.1-8

9) Set up the safety lanyard on the blue radome mounting base by running the end of the lanyard through the hole in the securing plate which will allow the white radome cover to hang most conveniently when the radar is being serviced at a later date. Put the sticker showing where the safety lanyard is stowed under the blue mounting base so that the servicing technician may easily locate it before actually reopening the radome at a later date. Replace the radome cover, making sure that it is oriented properly; i.e., with the narrow part of the groove on the top of the cover pointed forwards.

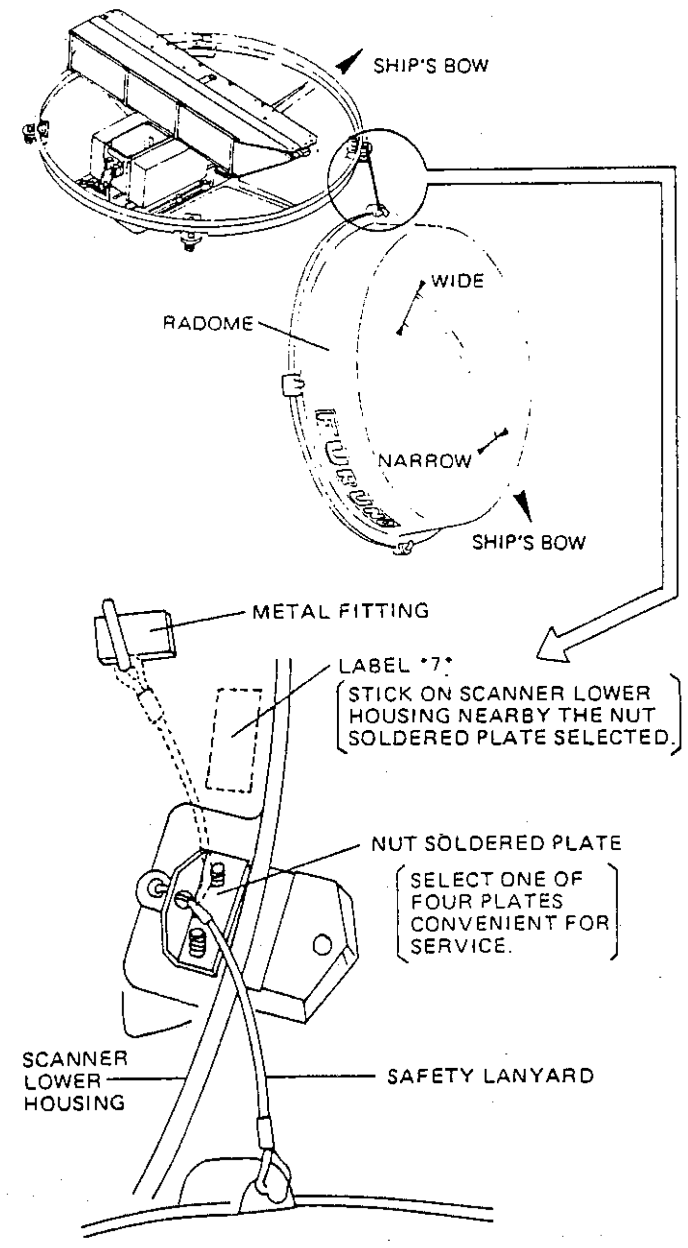


Fig.1-9

1.3 Display Unit

Locate the Display Unit in a position where it can be viewed and operated conveniently but where there is no danger of salt or fresh water spray or immersion.

Compass Safe Distance; The magnetic compass may be affected if the Display Unit is placed too close, because of fields generated in the radar. The compass safe distance (approx. 1.5m for standard compass and approx. 1.1m for steering compass) must not be disregarded.

The orientation of the Display Unit should be so that the radar screen is viewed while the operator is facing in the direction of the bow. This makes determination of your position much easier.

Display Unit Mounting

As supplied, the display unit is provided for tabletop mounting, but it can be easily converted for bulkhead/overhead mounting. See the next page.

1) Remove the mounting cradle from the display main body by undoing two bolts at the front bottom of the display unit. See Fig.1-10.

2) Drill four bolt holes of 12mm dia. through the tabletop to correspond to the fixing holes on the mounting cradle.

3) Secure the mounting cradle on the table by using M10 bolts, nuts and washers or coach screws and washers.

4) Place the display main body on the mounting cradle and secure it with the two bolts at the front bottom.

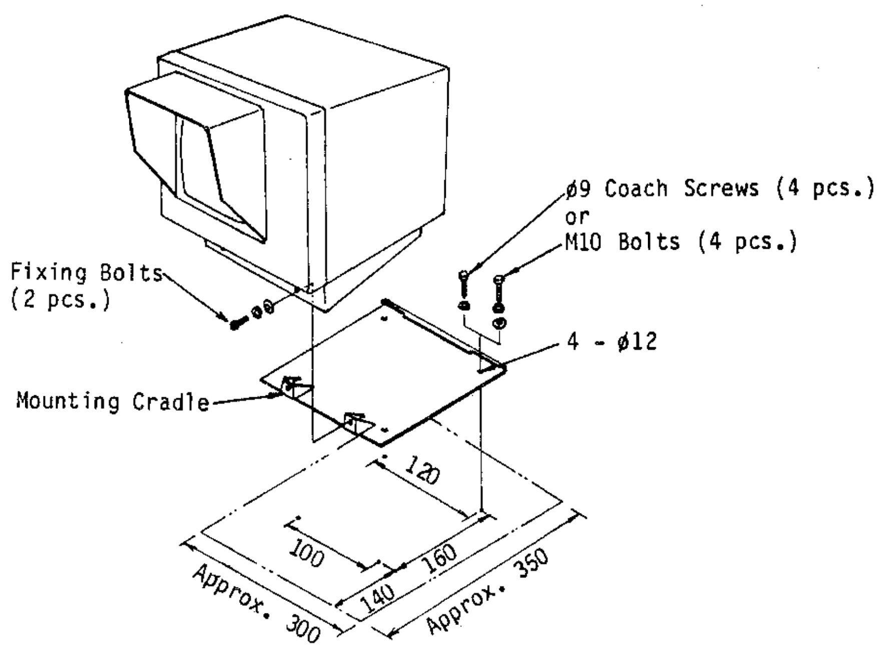


Fig.1-10 Display Unit Mounting

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Conversion from Tabletop Mount to Bulkhead/Overhead Mount

The tabletop mount type display can be converted to the bulkhead or overhead mount type by the following method.

1. Take off the top cover by loosening the four cosmetic screws.

2. Loosen the two M8 x 40 hex. bolts and remove the mounting cradle from the ramp base.

3. Remove the ramp base and bottom plate from the display main body by loosening the four M5 x 12 hex. bolts and the four M4 x 8 screws, respectively. See Fig.1-11.

4. Secure the bottom plate and ramp base removed in step 3 on the top of the display main body.

5. Fix the top cover on the bottom of the display main body.

6. To install the unit, secure the mounting cradle on the bulkhead or ceiling before assembling it with the ramp base.

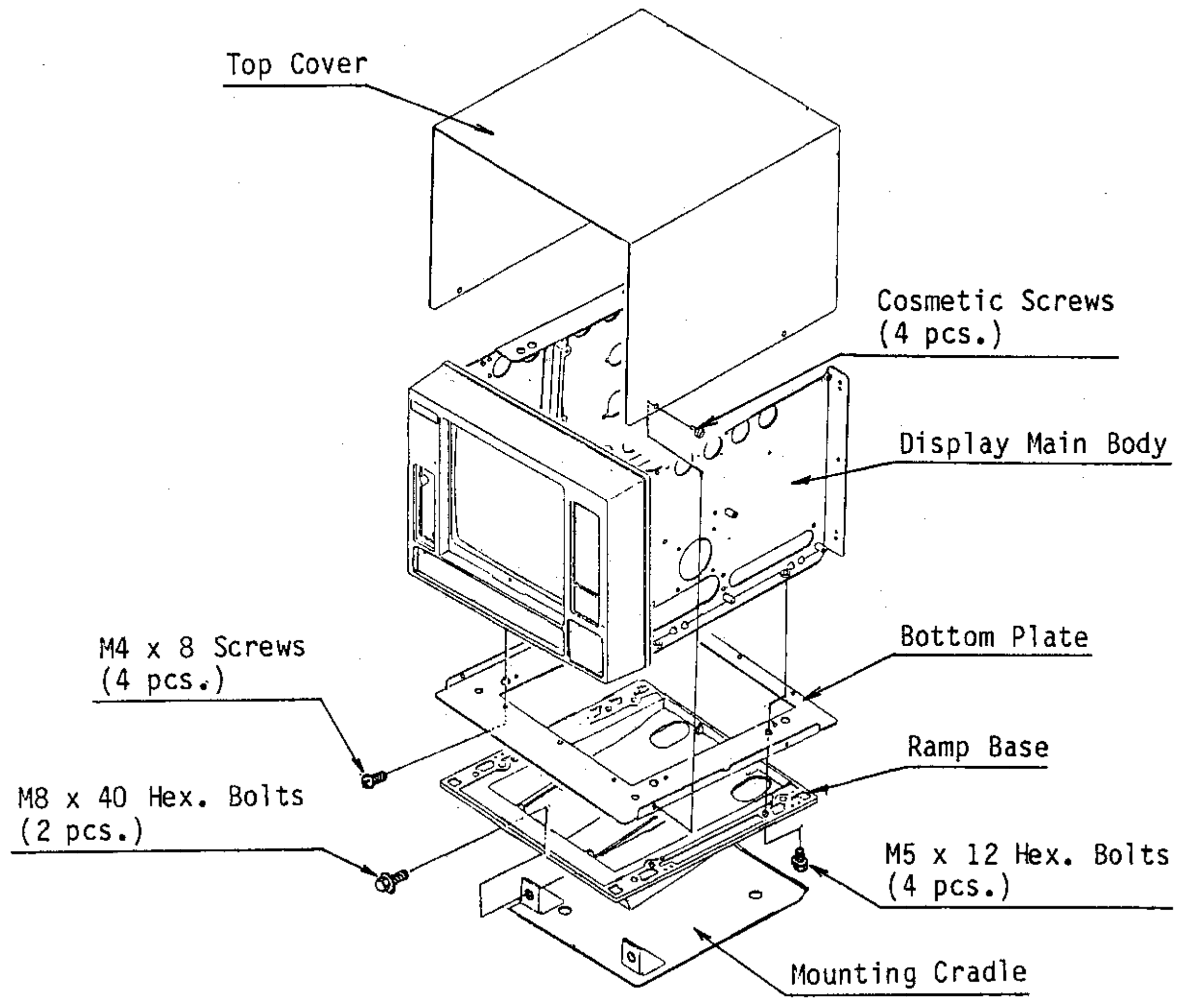


Fig.1-11

Connections to Display Unit

Two cables run to the display unit. These are;

a. multicore cable from the scanner unit
b. power cable from the ship's mains or rectifier

The multicore cable and power cable are`terminated with the connectors (24P connector DP1 and 2P connector P1351) at the display side. Connect them to the display unit as shown below.

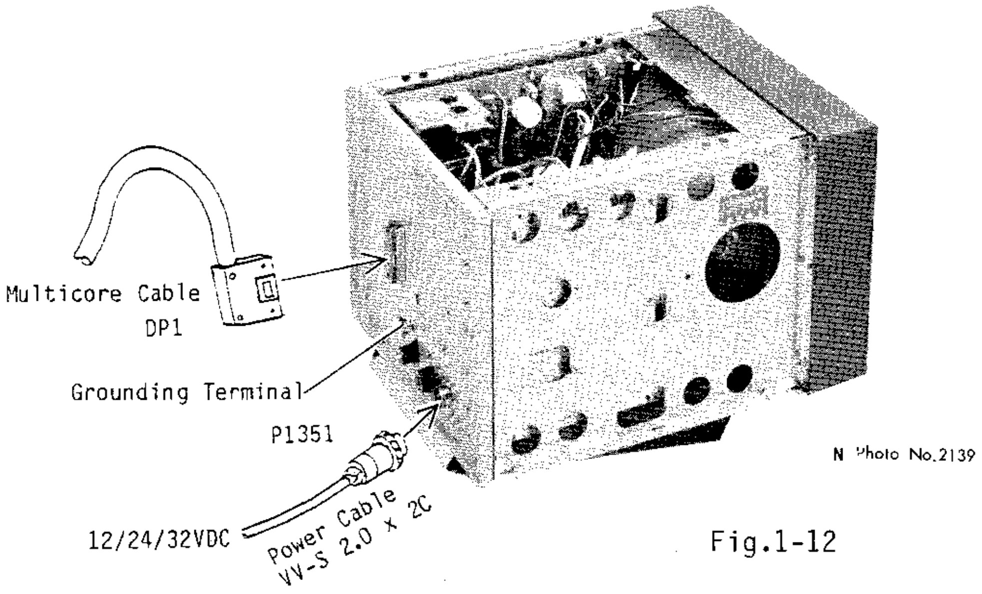
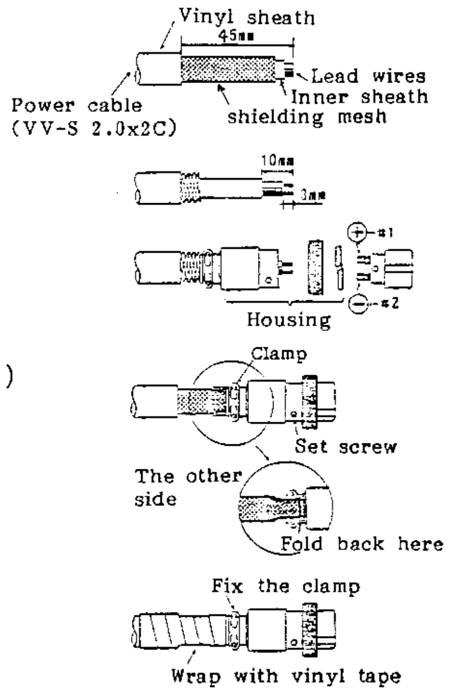
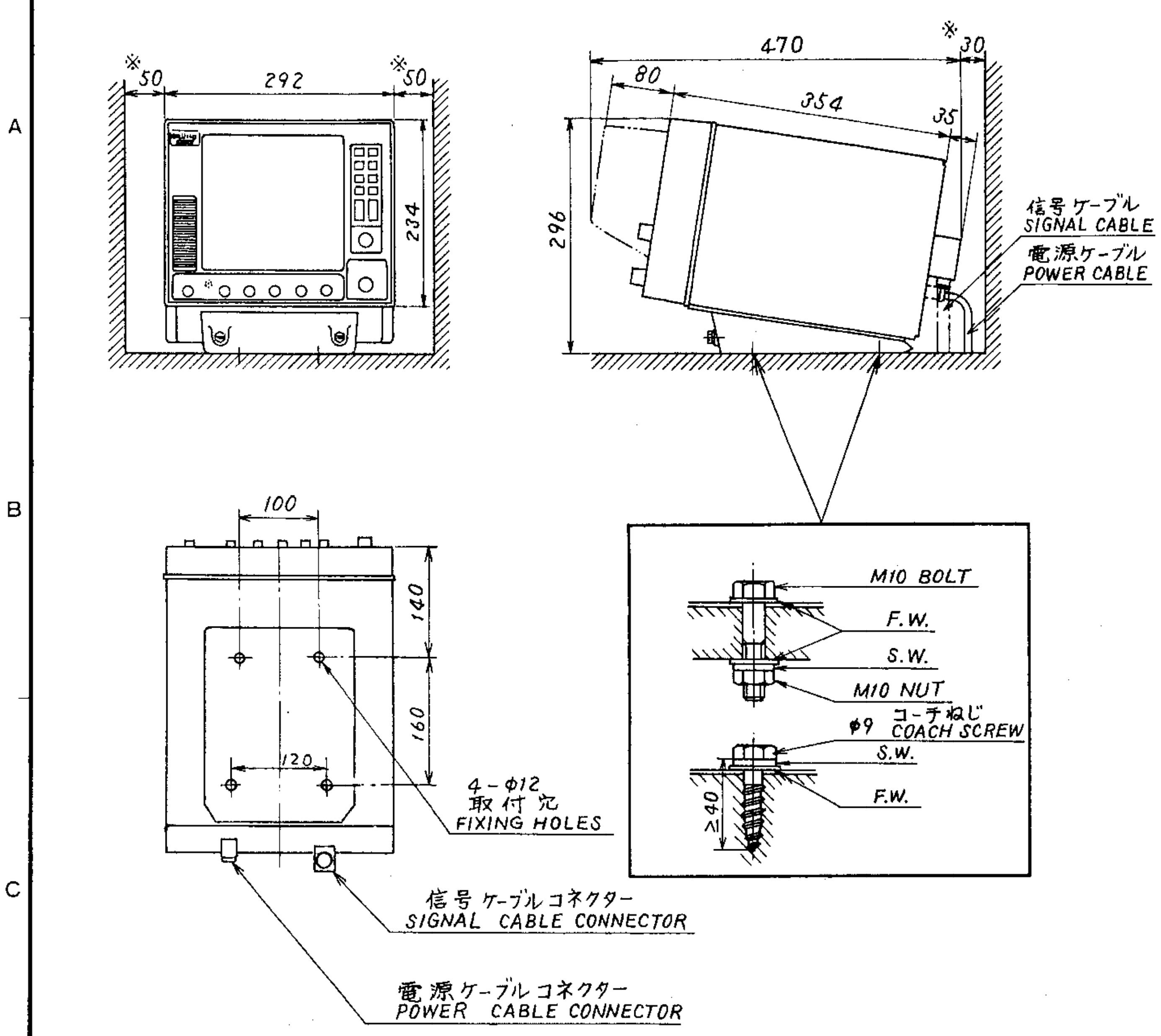


Fig.1-12

FABRICATION OF POWER CABLE

1. Remove 45mm of the vinyl sheath, taking care not to nick the shielding mesh, and then slide the shielding mesh back.
2. Remove 10mm of the inner sheath, and then remove about 3mm of the insulation from both ends of the lead wires.
3. Slide connector's housing over the cable.
4. Solder the lead wires to the connector, taking note of the polarity. (⊕…#1, ⊖…#2)
5. Assemble the connector, and then tighten the set screw.
6. Fold back the shielding mesh and clamp the connector over top of it.
7. Wrap the shielding mesh with vinyl tape.





NOTE 1. ※ : 推奨サービス空間。
RECOMMENDED SERVICING CLEARANCE.

NOTE 2. 装備ケーブルはサービス時、指示部を前方に十分引き出せるよう余裕をもたせること。
SUFFICIENT EXTRA CABLINGS SHOULD BE ALLOWED AT THE BACK OF THE UNIT SO THAT THE UNIT CAN BE DRAWN OUT WITH THE CABLES CONNECTED FOR MAINTENANCE.

FCR-900 SERIES	品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

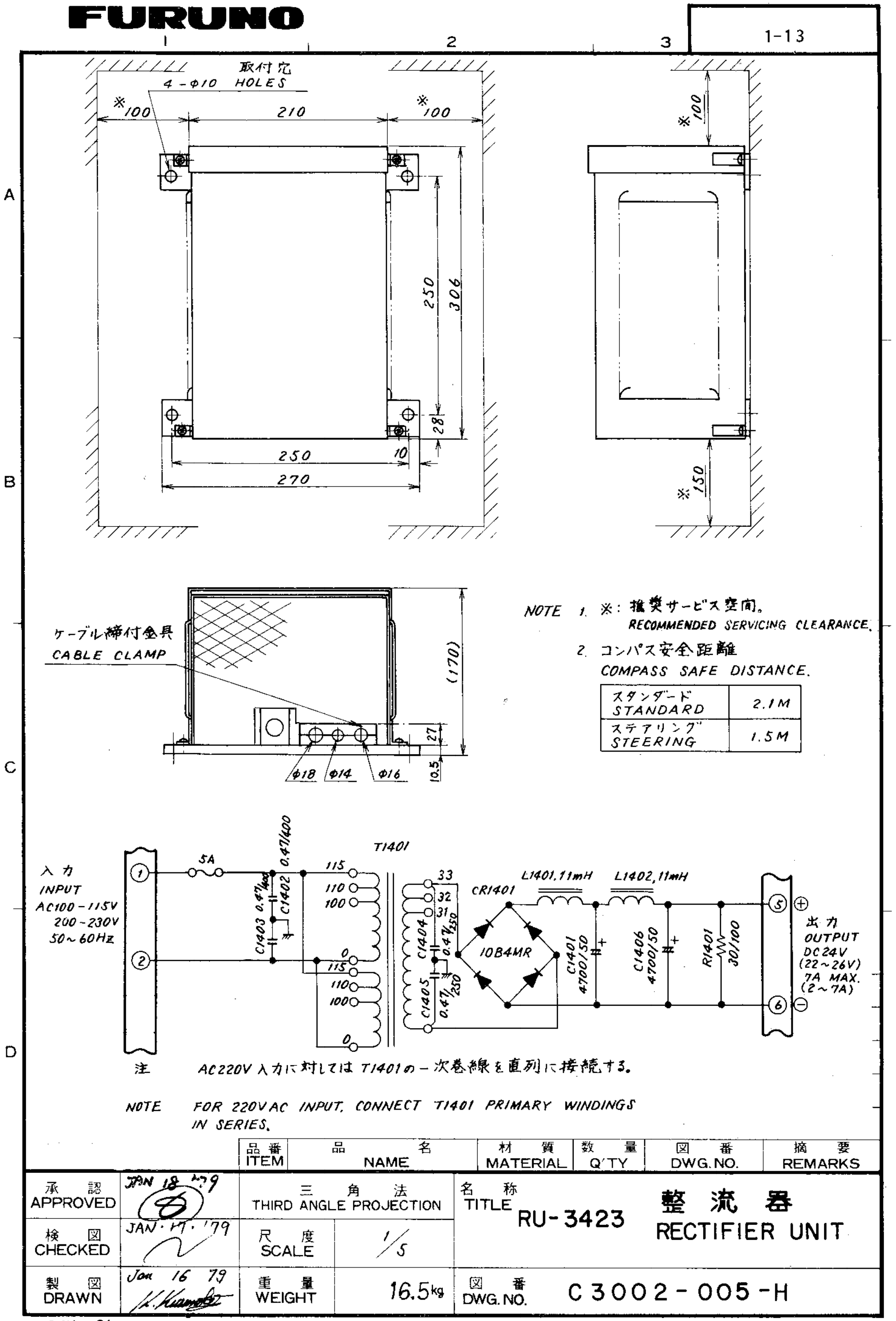
承認 APPROVED	JUNE. 26. '86	三角法 THIRD ANGLE PROJECTION		名称 TITLE	レーダー指示部外寸図 RADAR DISPLAY UNIT
検図 CHECKED	June. 26 '86	尺度 SCALE	1/8		
製図 DRAWN	June. 26. '86	重量 WEIGHT	12 kg	図番 DWG. NO.	C3293-010-A

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1.4 Rectifier Unit (Option)

For the set driven by 100/110/115/220/240VAC ship's mains, a rectifier unit is required. The unit can be mounted in any dry, well ventilated place. The mounting dimensions are shown in the rectifier outline drawing on page 1-13. The compass safe distance of 2.1m standard and 1.5m steering should be observed.

For connection to this unit, refer to the Schematic Diagram on page 1-13 and the Interconnection Diagram on page 1-6.



CHAPTER 2 ADJUSTMENT AT INSTALLATION

Items 1 to 3 should be adjusted at installation, while items 5 & 6 (marked by *) are preadjusted at the factory. Items 5 & 6 should be adjusted only when conditions (i.e., receiver gain is low, sea clutter function is ineffective) make it necessary.

1. Tuning
2. Sweep Timing
3. Heading Alignment
4. Magnetron Heater Voltage (Confirmation only)
5. Gain Preset (*)
6. Sea Clutter (*)

Tuning

If the best tuning condition is not obtained with the TUNE control set at its mid-travel, execute the following procedure.

Procedure:

1. Transmit the radar on 24 n.m. range with the TUNE control set at its mid-travel and wait about 10 minutes for magnetron oscillation to stabilize.
2. Adjust potentiometer VR4 inside the inner panel (Fig.2-1), located at the left hand side of the display unit, so that a comparatively weak long range echo is discerned with maximum definition.

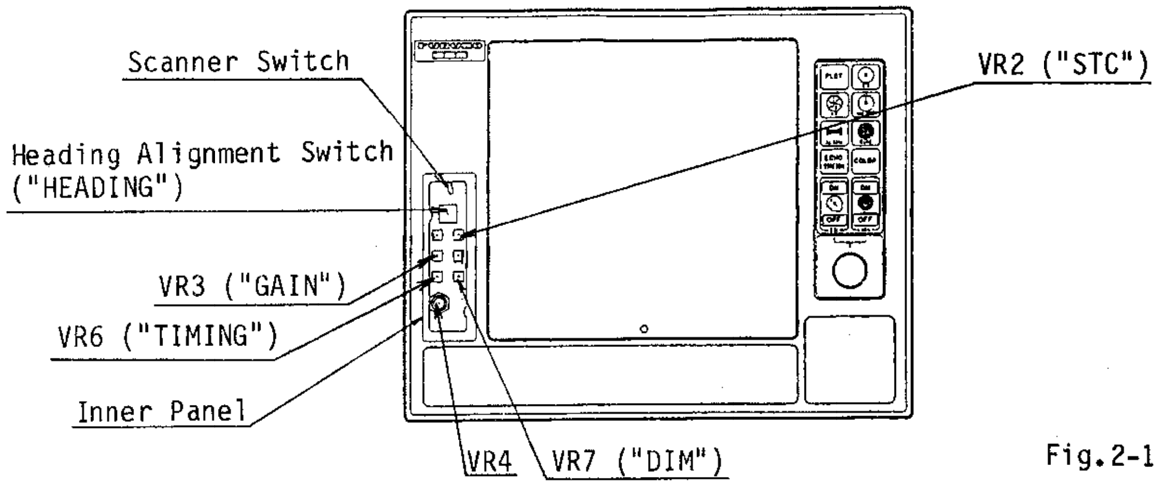


Fig.2-1

Sweep Timing

Sweep timing differs with respect to the length of the multicore cable between the display and scanner units. Perform the following adjustment at installation even if the standard cable of 10 meters was used.

Procedure:

1. Set the radar at 0.25 n.m. range and adjust the GAIN and SEA CLUTTER controls to obtain the picture.
2. Visually, select a straight object, e.g., a harbor wall, straight pier, etc.
3. Adjust potentiometer VR6 (Fig.2-1) so that the straight object appears straight with no "pushing" or "pulling" near the center of the picture. See Fig.2-2.



(A) Improper, pulling inward (B) Proper (C) Improper, pushing outward

Fig.2-2 Sweep Timing Adjustment

Heading Alignment

Procedure:

1. Operate the radar to obtain a normal picture on the screen.
2. Select a proper target echo (small island, end of quay, etc.) located on or around the heading flash and near the edge of the screen.
3. Press the EBL touchpad to present a EBL on the screen.
4. Operate the Marker control until the EBL is positioned over the center of a target.

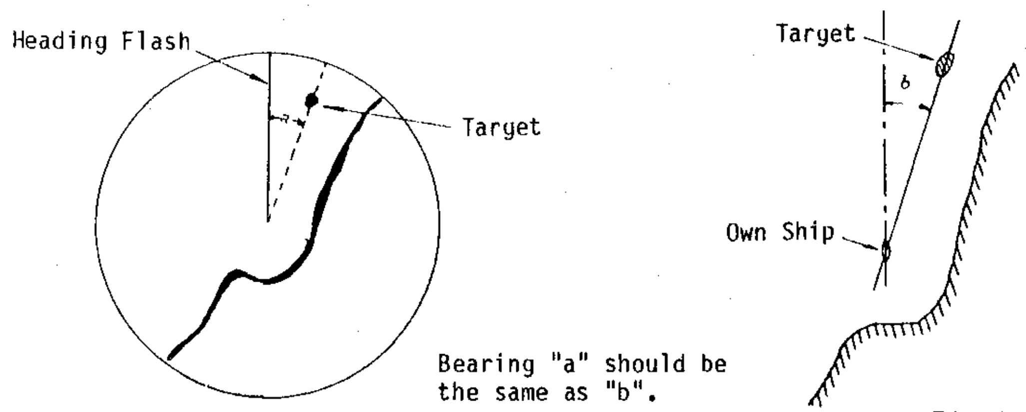


Fig.2-3

5. Read the EBL bearing at the bottom left of the screen. Next, by watching the ship's compass, find the relative bearing of the target from the ship's heading on the navigational chart. The relative bearing can also be made by visually measuring the direction of the target from the ship's bow using a dumb card.

6. The bearing of the target from the heading flash on the screen should be the same as that found on the navigational chart or the visual measurement. If there is a difference between them, adjust the Heading Alignment switch inside the inner panel in the display unit (Fig.2-1) to compensate for the difference (adjustable ±5°).

   NOTE: When adjustment can not be completed by the Heading Alignment switch, turn off the scanner switch (Fig.2-1) to suspend antenna rotation and change the position of the reed switch in the radome (Fig.2-4), then readjust the Heading Alignment switch. This should be made if the scanner unit is installed with a large error in direction.

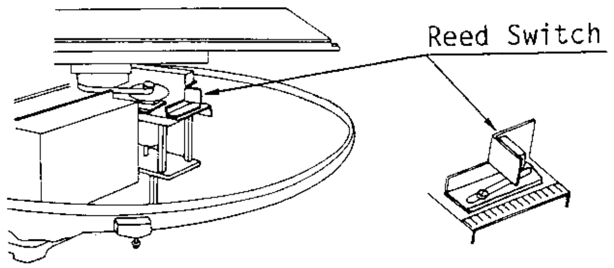


Fig.2-4

Magnetron Heater Voltage (Confirmation only)

Procedure:

1. Operate the radar in standby and 0.25 n.m. range.

2. Connect a multimeter, set to 10VDC range, between terminals #4(+) and #6(-) of the pulse transformer.

3. Confirm that the voltage is 6.0 to 6.6VDC.

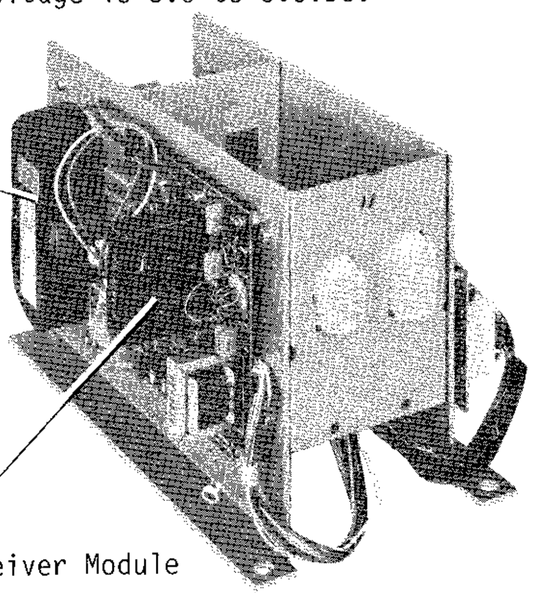


Fig.2-5 Transceiver Module

Gain Preset

Procedure:

1. Transmit the radar on 24 n.m. range.

2. Set the controls and touchpad keys as follows.

   SEA CLUTTER: Fully CCW, IR: "ON", ECHO STRETCH: "OFF",
   RAIN CLUTTER: "OFF" (pushed), GAIN: 3 o'clock position

3. Adjust potentiometer VR3 inside the inner panel (Fig.2-1) so that a little background noise (white noise) appears on the screen.

Sea Clutter

Procedure:

1. Transmit the radar on 12 n.m. range.

2. Set the controls and touchpad keys as follows.

   SEA CLUTTER: Fully CW, RAIN CLUTTER: "OFF" (pushed),
   IR: "ON", ECHO STRETCH: "OFF"

3. Tune the radar and turn the GAIN control so that the noise appears on the screen.

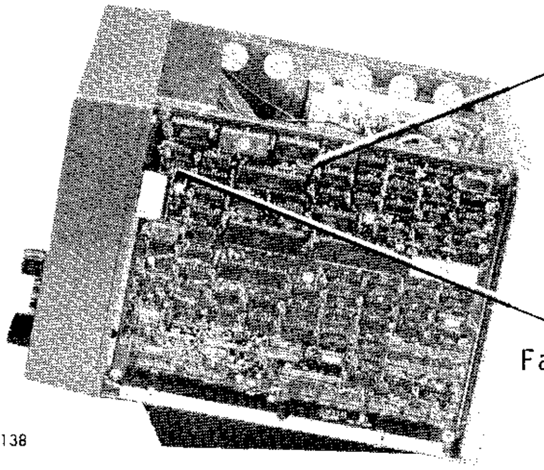
4. Adjust potentiometer VR2 inside the inner panel (Fig.2-1) so that the effective range of the sea clutter is 4 to 7 n.m.

Note that the illumination of the touchpads/front panel can be adjusted by the illumination pot. (VR7, "DIM") in the inner panel. See Fig.2-1. Clockwise turning of VR7 will increase the illumination.

APPENDIX 1 CHANGING THE SPECIFICATIONS BY AN INTERNAL DIP SWITCH

A 4-bit DIP switch S1 is located on the PROCESSOR board (03P6541). The specifications of the radar are changed according to the setting of the DIP switch, as shown below.

NOTE: When the change of the DIP switch setting is required in the field, turn off the radar before changing the setting.



N Photo No.2138

PROCESSOR Board (03P6541)



Internal DIP Switch (S1)

Factory Setting: #1 to #4 --- "OFF"

Switch Number	Specification
Switch #2	ON - The range value of No.2 VRM and the fixed range ring interval on the 0.25 and 0.5nm ranges are both displayed in kilometers. (There are 4 range ring intervals on the 0.25nm range, each at a 0.1km interval. And the fixed range rings on the 0.5nm range are spaced every 0.2km). OFF - The value of No.2 VRM and the interval of the range rings are displayed in nautical miles.
Switch #3	ON - When the antenna switch (located in the inner panel) is set to OFF during transmission, antenna rotation is suspended. OFF - When the antenna switch is set to OFF during transmission, antenna rotation is suspended and the radar is put in standby condition.
Switch #4	ON - The range of the alarm is fixed between 3 and 6nm. OFF - Any range may be used to set the alarm.

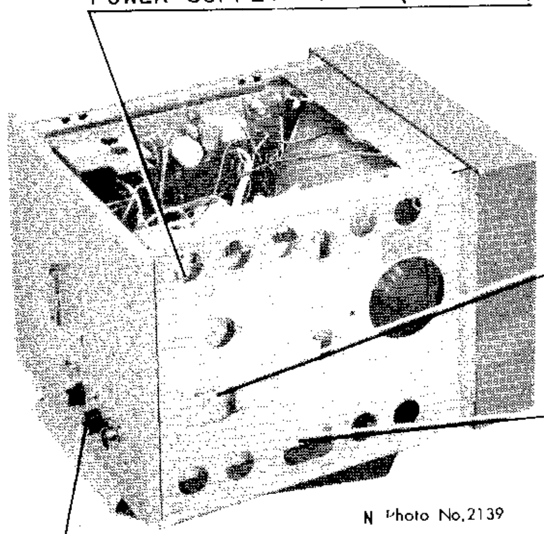
NOTE: DIP switch #1 is set at the factory; do not change the position.

APPENDIX 2 ALTERATION OF POWER SUPPLY

By changing the main fuse and jumper connections on the POWER SUPPLY board (03P6542) in the display unit, the radar can be operated from either 12VDC or 24/32VDC. (No modification is required for change between 24 and 32VDC.)

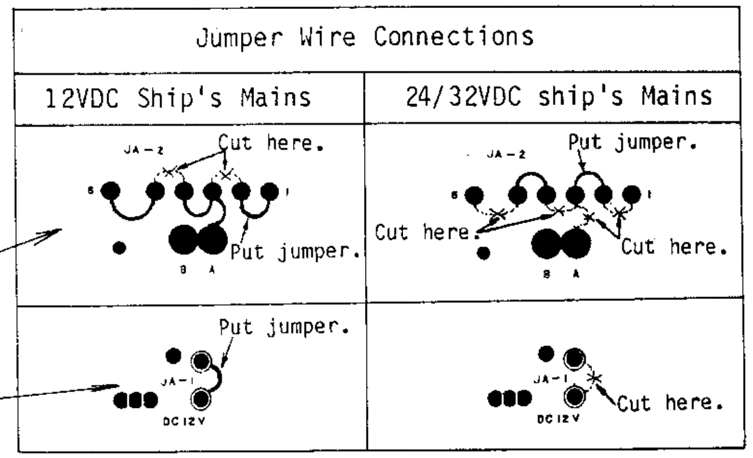
Mains Input	Main Fuse
12VDC (10.2 to 15.0V)	15A
24/32VDC (20.4 to 40.0V)	10A

POWER SUPPLY Board (03P6542)



N Photo No.2139

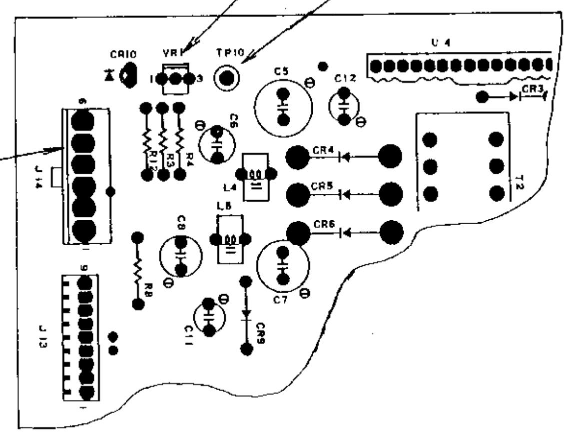
Main Fuse



VR1

TP10 (GND)

J14



POWER SUPPLY Board (Parts Side)

When the above modification is done, confirm that 12V line voltage is within the rating (11.8 ± 0.1V) by measuring the voltage between pin #5 (+) of J14 and TP10 (GND) on the POWER SUPPLY board. If not, adjust VR1 on the POWER SUPPLY board for the rating.

FURUNO ELECTRIC CO., LTD.

No. 9-52, ASHIHARA-CHO,
NISHINOMIYA-CITY, JAPAN

TELEPHONE : 0798-65-2111
CABLE : FURUNO NISHINOMIYA
TELEX : 5644-325/326 FURUNO J
TELEFAX : 0798-65-4200 (G II/G III)

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